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OBLON SPIVAK MCCLELLAND MAIER & NEUSTADT PC
FOURTH FLOOR
1755 JEFFERSON DAVIS HIGHWAY
ARLINGTON, VA 22202

EXAMINER	
LEUNG, CHRISTINA Y	
ART UNIT	**PAPER NUMBER**
2633	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/497,694	FRANCO ET AL.
	Examiner	**Art Unit**
	Christina Y. Leung	2633

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 October 2002*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *31-52* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *31-52* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 31 and 33-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over O'Mahony ("Non-Linear Optical Transmission Systems," 1993) in view of Antos et al. (US 5361319 A), Horiuchi et al. (US 5,726,789 A), and Fontana et al. (US 5570438 A) .

Regarding claims 31 and 40, O'Mahony discloses a pulsed transmission system and method (Figure 10), comprising at least one transmission station (including elements such as the "DFB laser" and "EA modulators" shown in Figure 10) for transmitting an optical signal at a transmission wavelength, at least one reception station ("soliton receiver"), a fiber-optic line linking the at least one transmission station and the at least one reception station and at least one optical amplifier ("booster amplifiers") serially linked along the fiber-optic line, wherein the fiber-optical line has an optical chromatic dispersion at the transmission wavelength and comprises:

a first optical conductor element, having a first chromatic dispersion at the transmission wavelength; and

a chromatic dispersion compensating unit (dispersion shifted fiber or DSF) having a second chromatic dispersion at the transmission wavelength.

O'Mahony does not specifically disclose that the fiber-optical line has a positive chromatic dispersion and that the chromatic dispersion compensating unit is of the opposite sign with respect to the first chromatic dispersion. However, Antos et al. teach a similar transmission system wherein a fiber-optical line and optical conductor element may have a positive chromatic dispersion and a chromatic dispersion compensating unit may have a negative chromatic dispersion (column 6, lines 30-35). It would have been obvious to a person of ordinary skill in the art to use the chromatic dispersion compensating unit taught by Antos et al. as an engineering design choice of a way to counter chromatic dispersion in the system disclosed by O'Mahony.

O'Mahony further discloses that the at least one transmission station comprises a high speed optical pulse transmitter adapted to generate an RZ optical signal at the transmission wavelength, bearing a coded information at a preset frequency (pages 638-639, section 6, "Soliton Experiments").

Claims 31 and 40 further recite that the ratio Tbit/Tfwhm, between the inverse Tbit of the preset frequency and the duration Tfwhm of the pulses, is higher than 6 and lower than 10. (Examiner notes that in other words, the width of the pulse [Tfwhm] is between 1/10 and 1/6 of the period [Tbit, the inverse of the frequency].) O'Mahony does not specifically disclose that the ratio Tbit/Tfwhm, is higher than 6 and lower than 10, but does teach that solitons should be sufficiently spaced apart so that they do not interact with each other (page 636, section 5.2.1, "Soliton interactions"). On the other hand, it is also well known in the art that if such a ratio were much higher than necessary to prevent interactions (in other words, if the solitons were spaced very widely apart), data may not be transmitted efficiently or as quickly as possible.

Horiuchi et al. further teaches that in large capacity soliton transmission systems, the pulse width should be 1/5 of the period or less (column 2, lines 18-22). In other words, they suggest that the ratio Tbit/Tfwhm may be 5 or higher (such as 6 or 8). They further teach compressing generated pulses to meet this criteria, and Fig. 7b shows an example wherein a 0.8 ps pulse is created so that it can be used in a 160 Gb/s system. In a 160 Gb/s system, the period is 6.25 ps; therefore, Horiuchi et al. suggests that Tbit/Tfwhm may be 6.25/0.8 (or ~7.8), which is within the claimed range.

It would have been obvious to a person of ordinary skill in the art to specify that the ratio Tbit/Tfwhm be higher than 6 and lower than 10 in the system disclosed by O'Mahony, simply to ensure that the solitons did not interact while ensuring that data be transmitted as efficiently as possible as Horiuchi et al. teaches.

O'Mahony does not specifically disclose that the optical pulses are substantially free from chirp, but Fontana et al. teach that solitons may be produced substantially free from chirp (column 2, lines 27-29). It would have been obvious to a person of ordinary skill in the art to ensure that the solitons in the system suggested by O'Mahony, Antos et al., and Horiuchi et al. were free from chirp in order to keep the signal as free of distortion as possible.

Regarding claim 33, O'Mahony discloses that the high speed optical pulse transmitter (Figure 10) comprises:

an optical pulse modulator (left-side EA modulator provided with a sinusoidal wave) adapted to modulate an optical signal with a sequence of periodic pulses having the duration Tfwhm and the preset frequency;

an optical signal modulator (right-side EA modulator) optically linked to the signal modulator, adapted to modulate the optical signal with the coded information; and

a generator of a continuous optical signal at the transmission wavelength (DFB laser), optically linked to the pulse and signal modulators.

Regarding claim 34, O'Mahony discloses that the chromatic dispersion compensating unit comprises a second optical conductor element (dispersion shifted fiber or "DSF") serially linked to the first optical conductor element (Figure 10).

Regarding claim 35, as well as it may be understood with regard to 35 U.S.C. 112 discussed above, O'Mahony discloses that the optical signal at the transmission wavelength has, for at least one portion of its propagation path in one of the first and second optical conductor elements, a intensity of a value such as to cause self phase modulation of the optical signal. O'Mahony clearly discloses that self-phase modulation of the signal can counter dispersive effects in order to produce balanced pulses (pages 634-635, particularly 5.1.1, "Self phase modulation").

Regarding claim 36, O'Mahony does not specifically disclose that the optical amplifier has amplification characteristics such that the optical signal at the transmission wavelength has, in at least one portion of its propagation path in one of the first and second optical conductor elements, an intensity of a value such as to undergo self phase modulation. However, as similarly discussed with regard to claim 35 above, O'Mahony suggests that the optical signal may undergo self phase modulation. It would have been obvious to a person of ordinary skill in the art to specifically use optical amplifiers of a particular amplification characteristic in the system as a way to induce the self phase modulation of the optical signal as O'Mahony already suggests.

Regarding claim 37, O'Mahony discloses that the first optical conductor element may be an optical fiber but does not specifically disclose that it may be a step-index optical fiber. However step-index optical fibers are well known in the art, as Fontana et al. in particular teach (column 6, lines 44-46) for use in a pulsed transmission system. It would have been obvious to specifically use step-index optical fiber in the system disclosed by O'Mahony as an obvious engineering design choice, especially since O'Mahony already discloses an optical fiber.

Regarding claim 38, O'Mahony discloses that the first optical conductor element is an optical fiber with non-zero dispersion. Regarding claim 39, O'Mahony also discloses that the fiber-optic line comprises chromatic dispersion compensation means (dispersion shifted fiber or DSF) adapted to compensate a fraction of the chromatic dispersion of the line and such that the total chromatic dispersion of the line is between 100% and 120% of the compensated dispersion. It would be recognized by a person of ordinary skill in the art that the DSF disclosed by O'Mahony is designed to substantially compensate dispersion in the line and therefore, close to 100% of the dispersion may be compensated.

3. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over O'Mahony in view of Antos et al., Horiuchi et al., and Fontana et al. as applied to claim 31 above, and further in view of Tamburello et al. (US 5267073 A).

Regarding claim 32, O'Mahony in view of Antos et al., Horiuchi et al., and Fontana et al. describe a pulse transmission system as discussed above with regard to claim 31. They do not specifically disclose or teach that the transmission station may comprise an interfacing unit.

However, Tamburello et al. teach that a transmission station (Figure 1) may comprise at least an interfacing unit (Figure 2) adapted to receive a first optical signal at the preset frequency

bearing the coded information, the interfacing unit including a receiving and converting unit 18 adapted to receive the first information-bearing optical signal, to convert it into an electrical signal bearing the coded information, and to feed the information-bearing electrical signal to the high speed optical pulse transmitter. It would have been obvious to a person of ordinary skill in the art to include an interfacing unit as taught by Tamburello et al. in the system described by O'Mahony in view of Antos et al., Horiuchi et al., and Fontana et al. in order to be able to adapt optical signals with existing specifications into the new system.

4. Claim 41 is rejected under 35 U.S.C. 103(a) as being unpatentable over O'Mahony in view of Antos et al., Horiuchi et al., and Fontana et al. as applied to claim 40 above, and further in view of AT&T Corp. (EP 0690534 A2).

Regarding claim 41, O'Mahony in view of Antos et al., Horiuchi et al., and Fontana et al. describe a pulse transmission method as discussed above with regard to claim 40. They do not specifically disclose or teach details regarding the step of generating the sequence of pulses. However, AT&T Corp. teaches that in a pulse transmission method (Figure 8), the step of generating the sequence of pulses may comprise combining a first periodic electrical signal (from phase control 530) at the preset frequency and at least one second periodic electrical signal at a second frequency which is a harmonic of the preset frequency (from frequency doubler 555 and phase control 565). It would have been obvious to a person of ordinary skill in the art to use the pulse generating step taught by AT&T Corp. in the method disclosed by O'Mahony in view of Antos et al., Horiuchi et al., and Fontana et al. as an engineering design choice of a way to generate RZ pulses to be modulated with data signals.

5. Claims 42-45 and 47-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over O'Mahony in view of AT&T Corp. and Horiuchi et al.

Regarding claim 42, O'Mahony discloses a high-speed optical pulse transmitter (Figure 10), comprising:

an optical signal modulator (right-side EA modulator);

an optical pulse modulator, optically linked to the signal modulator (left-side EA modulator); and

a generator of a continuous optical signal (DFB laser), optically linked to the signal and pulse modulators.

O'Mahony discloses that the signal and pulse modulators are driven by electrical signals, and it is well known that such modulators are driven by modulator drivers. O'Mahony does not specifically disclose details regarding drivers for the modulators. However, AT&T Corp. teaches that a signal modulator driver (Figure 8, element 540) for feeding the signal modulator with an electrical signal bearing a coded information with a first frequency may be used. AT&T Corp. further teaches a pulse modulator driver comprising:

a circuit (including phase control 530) for generating a first periodic electrical signal at the first frequency;

a circuit (including frequency doubler 555 and phase control 565) for generating a second periodic electrical signal at a second frequency which is a harmonic of the first frequency; and

a combining element 585 for combining the amplified first and second periodic electrical signals, and for feeding the pulse modulator with the combined signal.

AT&T Corp. does not specifically teach using the signal modulator driver and pulse modulator drivers to drive physically separate optical modulators, but instead teaches combining the electrical outputs to modulate one optical driver with both signal and pulse data. However, it would be well known in the art that the drivers taught by AT&T could be used to drive separate optical modulators as in the system disclosed by O'Mahony. It would have been obvious to a person of ordinary skill to use the modulator drivers suggested by AT&T Corp. to drive the modulators disclosed by O'Mahony as a way to generate data modulator RZ signals for transmission in the system.

AT&T Corp. does not specifically disclose that the two periodic signals may be amplified, but it would have been obvious to a person of ordinary skill in the art that such signals may be amplified with amplifiers as needed to produce signals of sufficient strength for use in the system as disclosed by AT&T Corp.

O'Mahony further discloses that the signal modulator emits a sequence of substantially chirp-free optical pulses (pages 638-639, section 6, "Soliton Experiments"). O'Mahony does not specifically disclose that the ratio Tbit/Tfwhm, between the inverse Tbit of the preset frequency and the duration Tfwhm of the pulses, is higher than 6 and lower than 10, but does teach that solitons should be sufficiently spaced apart so that they do not interact with each other (page 636, section 5.2.1, "Soliton interactions"). On the other hand, it is also well known in the art that if such a ratio were much higher than necessary to prevent interactions (in other words, if the solitons were spaced very widely apart), data may not be transmitted efficiently or as quickly as possible.

As already discussed above with regard to claim 31, Horiuchi et al. teaches that the ratio between the bit rate Tbit and the pulse duration Tfwhm may be greater than 5, and more specifically may be around 7.8, which is within the claimed range. It would have been obvious to a person of ordinary skill in the art to specify that the ratio Tbit/Tfwhm be higher than 6 and lower than 10 in the system disclosed by O'Mahony, simply to ensure that the solitons did not interact while ensuring that data be transmitted as efficiently as possible as Horiuchi et al. teaches.

Regarding claim 43, AT&T Corp. teaches that the circuit for generating the first periodic electrical signal at the first frequency is driven by a clock signal (from synthesizer 510) associated with the information-bearing electrical signal (Figure 8). Regarding claim 44, AT&T Corp. teaches that the circuit for generating the second periodic electrical signal comprises a frequency multiplier 555 linked to the circuit for generating the first period electrical signal. Regarding claim 45, AT&T Corp. teaches that the circuit for generating the first periodic electrical signal comprises an output for a synchronization signal (output from phase control 530), the synchronization signal being in a preset time relationship with the clock signal, the output being linked to the signal modulator driver (Figure 8). Regarding claims 43-45, again it would have been obvious to a person of ordinary skill in the art to use the modulator drivers suggested by AT&T Corp. to drive the modulators disclosed by O'Mahony as a way to generate data modulator RZ signals for transmission in the system.

Regarding claim 47, O'Mahony discloses that the transmission station as discussed with regard to claim 42 may included in a pulsed transmission system (Figure 10) comprising at least one transmission station (including DFB laser and EA modulator elements) for transmitting an

optical signal, one reception station (soliton receiver), one fiber-optic line linking the transmission station and the reception station and at least one optical amplifier (boost amplifier) serially linked along the fiber-optic line.

Regarding claim 48, O'Mahony discloses that the fiber-optic line has overall chromatic dispersion greater than zero at the wavelength of the optical signal, and regarding claim 49, O'Mahony also discloses that the fiber-optic line comprises chromatic dispersion compensation means (dispersion shifted fiber or DSF) adapted to compensate a fraction of the chromatic dispersion of the line and such that the total chromatic dispersion of the line is between 100% and 120% of the compensated dispersion. It would be recognized by a person of ordinary skill in the art that the DSF disclosed by O'Mahony is designed to substantially compensate dispersion in the line and therefore, close to 100% of the dispersion may be compensated.

6. Claim 46 is rejected under 35 U.S.C. 103(a) as being unpatentable over O'Mahony in view of AT&T Corp. and Horiuchi et al. as applied to claim 42 above, and further in view of Watanabe (US 4093919 A).

Regarding claim 46, O'Mahony in view of AT&T Corp. discloses a optical pulse transmitter as discussed with regard to claim 42 above. Neither O'Mahony, AT&T Corp., nor Horiuchi et al. specifically teach that the combiner element may be a distributed-constants circuit. However, it is known in the art that combiners may be distributed-constants circuits, as Watanabe in particular teaches (column 6, lines 64-68; column 7, lines 1-16). It would have been obvious to a person of ordinary skill in the art to use a distributed-constants circuit as the combiner in the system described by O'Mahony in view of AT&T Corp. and Horiuchi et al. as an engineering design choice of a way to manufacture the combiner element.

7. Claims 50-51 are rejected under 35 U.S.C. 103(a) as being unpatentable over O'Mahony in view of AT&T Corp. and Horiuchi et al. as applied to claim 49 above, and further in view of Meli et al. (US 5946117 A).

Regarding claim 50, O'Mahony in view of AT&T Corp. and Horiuchi et al. suggest a system as discussed above with regard to claim 49. Neither O'Mahony, AT&T Corp., nor Horiuchi et al. specifically disclose that the transmission station may comprise a plurality of transmitters. However, Meli et al. teach that a transmission system (Figure 14) including a transmission station, a reception station, a fiber-optic line and at least one optical amplifier, similar to the one suggested by O'Mahony, may include a plurality of high speed optical pulse transmitters 28a...d.

Meli et al. further teach that each transmitter may comprise a respective generator 28a...d of a continuous optical signal at a respective wavelength, different from that of the other units, each transmitter being able to generate an appropriate pulsed optical signal at a respective wavelength; and

a multiplexer 39 for combining the pulsed optical signals.

Wavelength division multiplexing as taught by Meli et al. is well known in the art, and it would have been obvious to a person of ordinary skill in the art to include multiple transmitters and a multiplexer as taught by Meli et al. in the system described by O'Mahony in view of AT&T Corp. in order to increase the data capacity in the system.

Accordingly, regarding claim 51, Meli et al. further teaches that the reception station may comprise a wavelength demultiplexer 26 for separating the pulsed optical signals. It would have been obvious to a person of ordinary skill in the art to include a demultiplexer as taught by Meli

et al. in the system described O'Mahony in view of AT&T Corp. and Meli et al. in order to recover the multiplexed signals.

8. Claim 52 is rejected under 35 U.S.C. 103(a) as being unpatentable over AT&T Corp. in view of Horiuchi et al.

Regarding claim 52, AT&T Corp. discloses a method (Figure 8) of high-speed optical transmission, comprising the steps of:

generating an optical signal (with laser 10);

modulating the optical signal (with modulator 30) with a periodic drive signal (output from combiner 585);

modulating the optical signal (with modulator 30) with an information bearing signal at a preset frequency (output from pattern generator 540); and

generating the periodic drive signal by combining (with combiner 585) a periodic signal at the preset frequency (output from phase control 530) and at least a periodic signal at a harmonic of the preset frequency (output from phase control 565). AT&T Corp. discloses that one of the periodic signals may be at the preset frequency while the other may be at a harmonic of the preset frequency (column 7, lines 2-20).

AT&T Corp. does not specifically disclose that the two periodic signals may be amplified, but it would have been obvious to a person of ordinary skill in the art that such signals may be amplified as needed to produce signals of sufficient strength for use in the system as disclosed by AT&T Corp.

AT&T Corp. further discloses that the signal modulator emits a sequence of substantially chirp-free optical pulses (column 1, lines 46-581 column 2, lines 43-50). AT&T Corp. does not

specifically disclose that the ratio Tbit/Tfwhm, between the inverse Tbit of the preset frequency and the duration Tfwhm of the pulses, is higher than 6 and lower than 10, but does teach that solitons should be sufficiently spaced apart so that they do not interact with each other. On the other hand, it is also well known in the art that if such a ratio were much higher than necessary to prevent interactions (in other words, if the solitons were spaced very widely apart), data may not be transmitted efficiently or as quickly as possible.

Again, as already discussed above with regard to claim 31, Horiuchi et al. teaches that the ratio between the bit rate Tbit and the pulse duration Tfwhm may be greater than 5, and more specifically may be around 7.8, which is within the claimed range. It would have been obvious to a person of ordinary skill in the art to specify that the ratio Tbit/Tfwhm be higher than 6 and lower than 10 in the system disclosed by AT&T Corp., simply to ensure that the solitons did not interact while ensuring that data be transmitted as efficiently as possible as Horiuchi et al. teaches.

Response to Arguments

9. Applicant's arguments with respect to claims 31-52 have been considered but are moot in view of the new ground(s) of rejection.

The amendment and response filed 21 October 2002 by Applicants is primarily directed to the limitation of Tbit/Tfwhm being "higher than 6 and lower than 10." Examiner has cited a new reference, Horiuchi et al., which addresses this amendment.

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christina Y. Leung whose telephone number is 703-605-1186. The examiner can normally be reached on Monday to Friday, 6:30 to 3:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jason Chan can be reached on 703-305-4729. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9314.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-4700.

Leslie Pascal

LESLIE PASCAL
PRIMARY EXAMINER